



LAWRENCE
LIVERMORE
NATIONAL
LABORATORY

LLNL-AR-662396

Lawrence Livermore National Laboratory, Advanced Test Accelerator (ATA) Building 865A HABS/HAER Report

R. Veseliza

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**LAWRENCE LIVERMORE NATIONAL LABORATORY
ADVANCED TEST ACCELERATOR (ATA) FACILITY
(Building 865A)**

Location: Northwest area of Site 300, Lawrence Livermore National Laboratory's (LLNL) Experimental Test Site located along Corral Hollow Road in Alameda and San Joaquin Counties, California.

Present Owner: Department of Energy/ National Nuclear Security Administration (NNSA)

Present Occupant: Vacant

Present Use: Vacant

Significance: The Advanced Test Accelerator (ATA) facility (Building 865A) was built in 1983 to investigate the feasibility of propagating intense electron beams through the atmosphere. Experiments were conducted in the ATA to test electron beams in the open air to determine how beams propagate in natural environments. This was done to consider the potential for military application of electron-beam propagation, in addition to considering the interaction of electron beams with lasers and plasmas.¹ Completed in the fall of 1983, the ATA facility was expanded in 1986 to conduct experiments using Paladin Free Electron Lasers (FELs) for the Strategic Defense Initiative Office (SDIO).

The significance of Building 865A lies in the important scientific accomplishments and events that took place within the facility.² The significance is conveyed in the important research efforts undertaken in the facility's laboratories associated with the development of significant ATA technologies at LLNL.

¹ Louise M. Rufer and Peter W. Murphy, eds. *Laser Program Annual Report - 1983*. UCRL-50021-83. Livermore: Lawrence Livermore National Laboratory, 1984.

² David Harvey. *Determination of National Register of Historic Places Eligibility Advanced Test Accelerator Facility Building 865*. Livermore: Lawrence Livermore National Laboratory, 2001.

Building 865A is also significant for its design.³ The Experimental Tunnel that housed the ATA underneath the main floor was built specifically for the accelerator and reflects the unprecedented activities that occurred on site.

Historian(s): Rinaldo Veseliza, AIA - Alisto Engineering Group
Mike Garavaglia, AIA - Garavaglia Architecture
Jacqui Hogans, AIA - Garavaglia Architecture
Alison Garcia-Keller- Garavaglia Architecture
Rebeca A.Ullrich- Corporate Historian, Sandia National Laboratory

Project Information: We gratefully acknowledge the following LLNL employees involved in gathering Historic documentation for this Report:
Crystal A. Quinly- ESPM Group Leader
Tom Grim- Assistant Manager, Environmental Safety & Health USDOE
Thom Kato- Manager, Environmental Functional Area
John E. Scott- Site 300 Director
Maxine Trost – Archivist, LLNL
Josie Sevilla- Photographer, Alisto Engineering Group
Kelly R.Heidecker-
Mark C. Evans
Winston J. Wong
Dawn Chase- Site 300 Special Projects Manager

I. HISTORICAL INFORMATION

A. PHYSICAL HISTORY ⁴

1. Date of Erection:

Building 865A The Advanced Test Accelerator (ATA) Facility
Designed: 1980
Construction Begun: 1983
Building completed: 1983

2. Architect: Kaiser Engineers, Oakland, California

³ Michael A. Sullivan and Rebecca A. Ullrich. *Historic Context and Building Assessments for the Lawrence Livermore National Laboratory Built Environment*. UCRL-TR-234717. Livermore: Lawrence Livermore National Laboratory, 2007: 248.

⁴ *ATA Complex, Lawrence Livermore National Laboratory, Key Plan Area*. Lawrence Livermore Laboratory Plant Engineering. LLNL Archives, 2002.

Kaiser Engineers designed and built Building 865A. Kaiser Engineers was one of American industrialist's Henry J. Kaiser's many and varied company groups. Kaiser Engineers provided engineering, project construction, and program management services to Kaiser companies and external clients including the U.S. military and the Department of Energy (DOE). At the height of the Cold War in the 1960s, Kaiser Engineers built the only dual-purpose reactor at DOE's Hanford Site. From 1982 to 1999, the company provided turnkey on-site engineering and construction services to other DOE projects including the ATA facility at LLNL.

3. Original and subsequent owners, occupants, uses:

The building has always been owned by the U.S. Government, as part of LLNL, one of the laboratories of the Atomic Energy Commission (AEC) and its successor agencies (currently the Department of Energy/ National Nuclear Security Administration [DOE/ NNSA]).

Building 865A was constructed to house experiments involving the feasibility of propagating intense electron beams through the atmosphere for potential military application. Programmatic material has been removed and the building is currently vacant.

4. Builder, Contractor, Supplier: Kaiser Engineers, Oakland, California

5. Original Plans and Construction:

In 1980, Kaiser Engineers completed the design for Building 865A and construction completed in 1983. Six additional support structures were built between 1980 and 1985, including Buildings 865B, C, D, E, G, and H (F was a small concrete extension that connected Building 865A with 865B). Of these, Buildings 865A and 865E were the core of the complex, respectively housing the ATA and the FEL. Buildings 865B, C, D, E, F, G, and H were support structures. The complex of buildings spanned approximately 60,319 square feet. Building 865A itself comprised 28,659 square feet of the total complex.⁵

6. Alterations and Additions

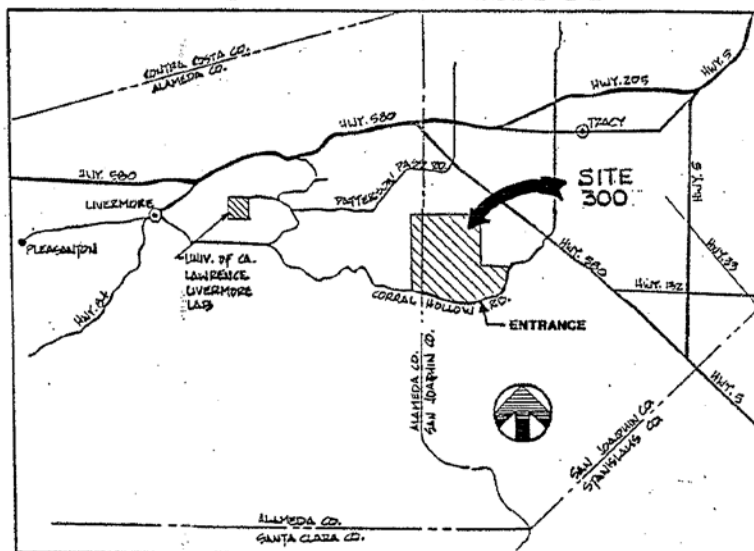
Building 865 was expanded in 1986 to conduct experiments using Paladin FELs for the SDIO.

7. Site Maps:

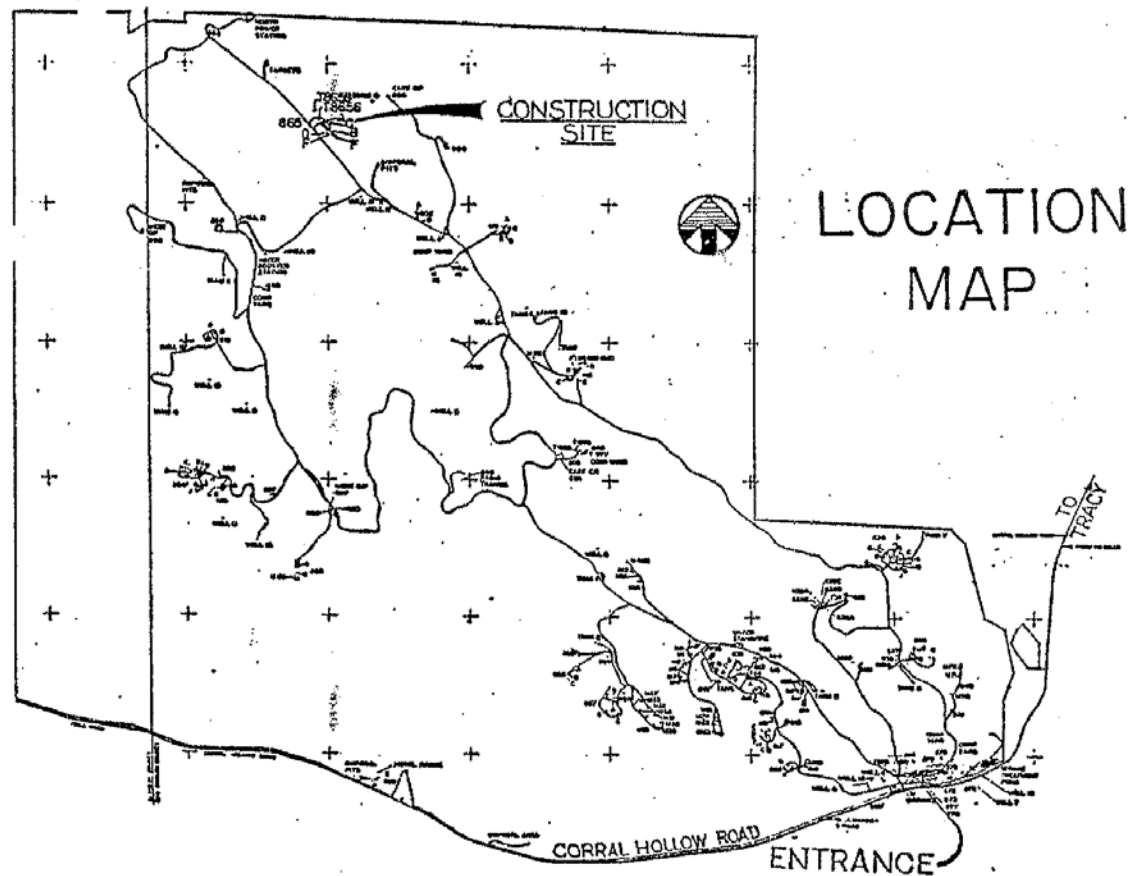
⁵ Sullivan and Ullrich, 2007: 246.



VICINITY MAP



Site 200 and Site 300 Vicinity Map. 1980 LLNL Plant Engineering



significantly increase the U.S. stockpile. Convinced that a second laboratory would accelerate the process of building up a nuclear arsenal, the AEC established the LLNL in September of 1952 as a second nuclear weapons design facility.⁶

Herbert York, the first director of LLNL, articulated four missions for the new laboratory; including designing thermonuclear weapons, providing diagnostic measurements for weapons tests for LANL and LLNL, developing a controlled thermonuclear reaction for power sources, and basic physics research. York was in strong pursuit of both weapons and non-weapons related research, as he felt that a diversified research program at LLNL would attract the country's brightest young scientists.⁷

Although LANL developed and tested the first thermonuclear device, LLNL was not far behind. Just six months after LLNL opened its doors, scientists fired their first thermonuclear test device at the Nevada Test Site (NTS). Code-named Ruth, the device fired below expectations. The next several LLNL tests had similarly mixed results. By the 1955 NTS, LLNL scientists had fine-tuned their designs and successfully tested a thermonuclear device with the breakthrough Teapot test series. Soon after, both LANL and LLNL were focused on designing thermonuclear weapons for the Army and Navy.⁸

2. Establishment of the ATA

Scientists at LLNL had been performing research in the field of charged particle beam technology for nearly 20 years before the construction of the ATA facility. Leading the way in 1959 was the ASTRON program with the principle of magnetic induction to accelerate voltages. In 1978, the innovative Experimental Test Accelerator (ETA) was completed to test the novel linear-induction technology. The commencement of the large-scale FEL program at LLNL was linked to the expansion of the ATA program and the construction of Building 865A at LLNL's Site 300.⁹

Completed in 1983, Building 865A was constructed to investigate the feasibility of propagating intense electron beams through the atmosphere. The LLNL Beam Research Branch carried out both the design and construction of the ETA and ATA accelerators.

Isolated from large population centers, Site 300 was the ideal place to test the 50 million electron volt (MeV)/ 10 kilo amps (kA) induction accelerator and the propagation of intense electron beams through the atmosphere. Located in a

⁶ *Ibid.*, p. 7-9.

⁷ Herbert York, "Making Weapons, Talking Peace," *Physics Today* (April 1988).

⁸ Sullivan and Ullrich, 2007: 57-59.

⁹ Harvey, 2001.

tunnel below the main floor of Building 865A, measuring approximately 279 feet in length, the linear electron accelerator consisted of four major units; a pulse-forming network, an electron injector designed to produce a repetitively pulsed electron beam to conduct charged-particle beam research, a series of 190 separate accelerator modules or cells, and an experiment tank. This pulse-forming network provided short, high-voltage pulses that powered the electron injector and accelerator cells.¹⁰ The injector produced a beam of electrons at 2.5 MeV that was subsequently accelerated to 50 MeV by the accelerator modules. Once at full energy, the electrons were then guided to the experimental tank for beam propagation studies, including an array of magnets called a “wiggler” for the FEL experiments.

Experiments conducted in the ATA tested electron beams in the open air to understand how these beams propagated in natural environments. Many beam stability and propagation experiments were conducted in the shielded gas-filled experiment tank in the ATA tunnel. The beam was also directed outside of the building to determine specifically how beams propagated in the atmosphere and to test methods of pointing and tracking. Though not built to be a weapon, the ATA was to be used to evaluate the potential of electron beam technology for future defensive weapons. At the time, the ATA was the most advanced induction linear accelerator in the nation and represented the largest single component of the Particle Beam Technology Program funded by the Defense Advanced Research Projects Agency (DARPA).

Characterized as "Stars Wars" in a speech by President Ronald Reagan in March 1983, the particle beam weapons program was the beneficiary of an enormous expansion in funding for particle beam and FEL research due to Reagan's support of the SDIO. The SDIO was responsible for the research and development of a space-based system to provide the United States with a defensive shield from enemy ballistic missiles. In the mid- to late-1980s, the SDIO contributed significant funding to support research experiments at the facility. Later experiments focused on investigating the feasibility of using large FELs as weapons to destroy enemy missiles by utilizing mirrors on satellites to deflect beams onto specified targets.

Generating Electron Beams for Military Applications

Early Research

The establishment of the FEL program and particle beam research for military application had origins dating back to the Second World War. Later scientific research during the Cold War was directed at providing complex defenses against the Soviet Union and their nuclear weapons, which included the scientific testing of a particle beam weapon system.

¹⁰ *Ibid.*



DARPA officials used electron beam data to help determine the feasibility of constructing particle beam weapons. They believed that a space-based laser would have the capability to damage sensitive sensors on hostile spacecraft at significant ranges.¹¹

The possibility of Soviet advances in particle beam development in the late 1970s prompted scientists in the Particle Beam Weaponry (PBW) Program to develop electron beam accelerators for United States missile defense.

Military Capabilities

The applicability of charged particle beams for use as weapons represented a potential breakthrough in military capability.¹² The question of whether the particle beams had the capability to shoot down attacking missiles depended upon whether a particle beam of any sort could propagate through the atmosphere without significant energy loss to a militarily significant target.

LLNL researchers conducted a comprehensive program of electron-beam propagation experiments in Building 865A to determine whether a charged beam could propagate without serious deflection by the earth's magnetic field.¹³

LLNL scientists promoted the advantages of charged-particle beam weapons by claiming that beams would detonate simply by colliding into their target. As the particle beam moved close to the speed of light in a straight line, there was no need for complicated guidance systems as anything in a beam's path would receive the full extent of its energy.

The goal of the program at the ATA facility was to enhance the laser's power to be most effective. In positioning a laser beam in line with an electron beam, scientists demonstrated that a FEL could supplement the additional energy needed by the laser beam to yield best results.

To do this, an array of magnets (a wiggler) will be used to oscillate free electrons, those not attached to an atom, causing the electrons to give off a beam of electromagnetic radiation. Some of the energy is transferred from the electrons to a parallel laser beam, thereby making the laser beam more powerful ... this enhanced laser beam could be fired from a ground-based station into outer space where a 3-foot-diameter beam will bounce off of orbiting mirrors and focus onto ... an invading ICBM [inter-continental ballistic missile].¹⁴

¹¹ Harvey, 2001.

¹² Harvey, 2001.

¹³ *Ibid.*

¹⁴ *Ibid.*, p. 2a

The FEL would be the ground-based portion of a "Star Wars" defensive system. Directed into space, the laser beam would reflect off satellite-affixed mirrors and subsequently destroy incoming missiles. In theory, the FEL weapon would vaporize the shell of a targeted ICBM.

The Lab's FEL technology also lent itself to applications in non-defense fields, including fusion, high-energy physics, atmospheric sciences, and space transportation.¹⁵

ATA Design

Located in a 540-foot long underground tunnel, four major functional parts comprised the ATA.¹⁶ This included:

1. A 2.5-MeV/ 10-kA triode injector (with ten induction cells each supplying 250-300 kilo-volts [kV])
2. A 50-MeV accelerator
3. A beam transport section
4. An experimental tank

Power conditioning systems and pulse-forming networks, housed directly above the accelerator's main floor, fed energy to accelerator cells below through semi-flexible, oil filled cables.

Injector

A substation at the ATA site provided the necessary electrical power to the injector. From a transformer on the main floor of the substation, electricity was pumped into storage devices known as Blumleins. The Blumleins fed both the injector's induction coils and the accelerator cells, creating a strong electrical field between the cathode and the anode. After the electrons had boiled off of the cathode, they were accelerated by the electric field and through a wire grid towards the anode.¹⁷

Power Conditioning Area

Located above the accelerator, the power conditioning area (PCA) consisted of the necessary systems and hardware to convert line power to shorter, high-power pulses required to accelerate the electron beam. The pulse-power assembly in the PCA was a unit comprised of a transformer, a spark gap, and a Blumlein transmission line comprised of three concentric, metal conducting cylinders, and oil-filled cables that provided energy to the accelerator cells below.

¹⁵ Ross, 1986, in Harvey, 2001.

¹⁶ Harvey, 2001.

¹⁷ *Ibid.*

Accelerator

Once leaving the injector, the beam passed along to the accelerator and sequentially through 190 accelerator cells. The induction accelerator (47.5 MeV) was the second major unit in Building 865A, with its individual accelerator cells or modules serving as the heart of the ATA. Each accelerator cell added incremental kinetic energy to the beam. In increasing the number of modules that made up the accelerator, one could increase the beam energy to any desired level.

In the accelerator, the 2.5-MeV electron beam was guided for 279 feet by focusing solenoids and steering magnets through the 190 accelerator cells, each of which supplied 250 kV for an additional energy gain of 47.5 MeV.¹⁸ The drive pulse that this produced was transported through the previously mentioned oil-filled cables from the overhead power conditioning equipment. Electrons then passed from one cell to the next, increasing in momentum, until they attained an energy of approximately 50 MeV. It was crucial that the precise timing of the voltage pulses to the cells be coordinated with the arrival of the beam.¹⁹

Beam Transport Section and Paladin FEL

Once at the end of the accelerator, the beam was magnetically guided through the 140-foot long beam transport section to an experimental area. The beam transport section ensured that the accelerator section was isolated from the experimental area, permitting space for diagnostic instruments to evaluate the beam's characteristics.

The Paladin FEL in the beam transport section worked by transmitting an intense electron beam through a periodic, linear array of magnets called a "wiggler."

The configuration and movement of the electrons in the magnetic wiggler caused the electrons to bunch into thin segments, which transferred their energy into a beam of electromagnetic energy that radiated at optical frequencies. The converted energy became coherent, visible light in the form of a powerful laser beam.

Experimental Tank

At the end of the beam transport section, electronic beams were guided by a series of steering and focusing magnets into either a large experimental tank that was filled with gases of various compositions and pressure, or were directed out into the atmosphere for testing and tracking purposes.²⁰

¹⁸ *Ibid.*

¹⁹ Nelson, 1981, in Harvey, 2001.

²⁰ Harvey, 2001.

"Star Wars" and Beyond

Critics argued that the "Star Wars" program would encourage the militarization of space and potentially destabilize the nuclear balance of power. Additional critics scrutinized the ATA project as being technologically unfeasible and unable to defend itself against cruise missiles, airplanes, or other delivery systems.²¹ Furthermore, countermeasures by the former Soviet Union to new SDI technologies would have been simple to implement, and may have included decoy missiles and armed missile shielding. The end of the Cold War led to criticism that SDI were unnecessary, and in 1991 President George Bush called for a more limited version using rocket-launched interceptors based on the ground. However, tests in the late 1990s found numerous serious flaws with this approach, prompting the SDIO to narrow their research focus on developing missile defense systems for battlefield applications.

Enormous expenditures of Star Wars systems may have put a considerable strain on the Soviet economy in their attempt contend with the United States in electron beam propagation research. Many FEL program supporters maintain that the technical and economic challenges of Star Wars contributed to the disintegration of the Soviet Union and the end of the Cold War.

THE LAST LARGE-SCALE EXPERIMENT AT THE ATA FACILITY TOOK PLACE IN JANUARY 1990. LASTLY, A SMALL GROUP OF RESEARCHERS USED THE ACCELERATOR AND ITS FACILITY FOR MICROWAVE PRODUCTION EXPERIMENTS BETWEEN 1990 AND MAY OF 1995.²²

²¹ *Ibid.*

²² *Ibid.*

II. ARCHITECTURAL INFORMATION

A. GENERAL STATEMENT

1. Architectural Character

Site 300 at the Lawrence Livermore National Laboratory originally included the 865 complex, which was comprised of building 865A and seven support structures. Buildings 865A and 865E are connected by the narrow underground Building 865B, which together form a long central structure, creating the bulk of the complex.

Built in 1983, Building 865A was constructed specifically to house the Advanced Test Accelerator. It is an industrial building that was designed to support and accommodate the machines it housed and subsequent related research endeavors. As such, its materials, finishes and lack of windows are reflective of its solely utilitarian purpose.

2. Condition of Fabric

The building has remained inactive and vacant for many years. It has not required any upgrades and therefore the building systems and mechanical components are not functional or current to code. The exterior cladding shows extensive weathering and corrosion which would require significant cost to upgrade to current codes requirements.

B. DESCRIPTION OF EXTERIOR

1. Overall Dimensions

The two story industrial building is rectangular in footprint, and comprised of two differently proportioned rectangular volumes, built specifically to house the functions of the ATA. The building is approximately 28,659 square feet. They will herein be referred to as the 'smaller' and 'larger' volumes, respectively.

Lying to the north, the smaller of the two volumes measures 70 feet by 81 feet 4 inches. The majority of the lower floor of the building is partially below-ground, with the exception of an approximately 2 foot grade reveal on the north east and north west portions. The western elevation of this portion of the building is not below ground, and is pedestrian accessible at the lower floor. Measuring from the top of the upper floor to the flat roofline, the smaller of the building's two volumes extends 17 feet high.

The second, larger, rectangular volume sits to the south, and measures 322 feet and 4 inches long and 70 feet wide across the entire upper floor. This volume's

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As noted on the 1980 “Road Elevations and Lean Concrete Shielding for Acceler. [sic] Tunnel” plan drawn by R.K. Kuechlghe, the below-ground accelerator tunnel is shielded above with a lean concrete fill. A top rests an additional layer of earth and/ or concrete fill. Both floors are of reinforced slab concrete foundation.²³



The building's exterior included both concrete and insulated corrugated-metal surfaces.

²³ *Road Elevations and Lean Concrete Shielding for Acceler. [sic.] Tunnel, Building 865 Advanced Test Accelerator. Lawrence Livermore Laboratory Plant Engineering, drawing PSA80-865-113B. LLNL Archives, revised Sept. 1980.*

Tunnel. The exterior walls of the smaller volume measure approximately 19 feet high (above grade), 1 foot thick, and are of an unfinished poured concrete.

The walls of the larger, longer volume, measure approximately 26 feet high (above grade) and are covered in an insulated metal siding throughout the remaining length of the building. The walls appear to be approximately 6 inches thick. This difference in wall height, thickness and material emphasizes the “two volume” building composition as described above.

4. Structural System and Framing

As noted in early construction photographs (c. 1980), the larger volume has a steel frame with poured concrete walls on its upper floor. The lower floor’s arched metal walls are attached to a steel space frame.

The smaller volume is comprised of reinforced poured concrete walls.²⁴

5. Porches, Stoops, Balconies, and Bulkheads

There are no porches, stoops, balconies or bulkheads present at this building. There are, however, several concrete pads immediately surrounding exterior doors. A concrete ramp and steps lie to the north of the building, servicing the main entrance.

6. Chimneys

There are no chimneys present at this building.

7. Openings

a. Doorways and Doors

The smaller volume’s western elevation includes a large industrial roll-up door and a smaller pedestrian door. The main point of entry is a single door on the northern elevation of the building. On the upper floor, there are four single doors and one pair of double doors on the eastern elevation and one single door and two double doors on the western elevation as emergency exits, which service the length of the building.

b. Windows and Shutters

²⁴ These are assumptions based on ATA building construction photographs (c.1980-83) and on HABS/ HAERS photographs taken by Kelly Heidecker in 2001.

Exterior windows could not be identified at this building through plans or photographs.

8. Roof

a. Shape and Covering

The roof of the smaller volume is flat, covered in an unknown roofing material. The roof of the larger, and longer, volume is hipped with a gentle pitch. It appears to be covered in the same corrugated metal material as the exterior walls of this portion of the building.

C. DESCRIPTION OF INTERIOR

1. Floor Plans

The smaller, concrete volume of the building houses six offices and respective laboratories for the ATA. The exact programming and usage of the rooms are unknown. Three larger rooms, 100, 105 and 106, feed from the off-center hallway at the northern main entrance. Rooms 100 and 106 are accessed by a small staircase and landing. Images from when the building was in-use depict control consoles and computers organized in a semi-circular formation, which lined the perimeter of room 106.

A smaller configuration of this cabinetry unit was also utilized in room 100. A smaller room, Room 106A, is tucked into the southern corner of room 100. Two smaller rooms are also off of the main hallway, Rooms 101 and 103. A smaller room, 105A, has a single window and is tucked into Room 105.²⁵ The exact usage of the lower floor on this portion of the building is unknown.

The remainder of the building, houses the various ATA related equipment (including the Power Conditioning Unit, trigger systems, power supplies, transformers and spark gaps) on the upper floor of Room 110. The lower floor houses the injector and accelerator cells which span from Room B110 through Room B120 where the Beam Transport section, Paladin FEL and Experimental Tank lie. The accelerator cells continuously span further down the Accelerator Tunnel to Rooms B120A and B120B. Room B110 has smaller room or closet labeled "B110A."

2. Stairways

²⁵ *Advanced Test Accelerator Facility Bldg. Plans with Equipment Locations*. Lawrence Livermore Laboratory Plant Engineering, drawing PSA 81-865-105D. LLNL Archives, revised April 1981.



A short internal stairway is visible immediately upon entry through the northern vestibule on the upper floor. This leads up to a small landing from which Rooms 100 and 106 are accessible. There are two enclosed half-turn stairways allowing for access between the upper and lower floors on the eastern side of the building; one near the centralized injector and the other at the southern end of the building.

3. Flooring

The flooring in the first floor offices of the smaller volume is either a carpet tile or vinyl tile material. The flooring in the second floor of this portion of the building is unknown.

From photographs of the building, it has been determined that the upper and lower floors of the larger volume are of finished concrete.

4. Wall and Ceiling Finish

There are acoustic ceiling tiles and plaster walls in the office rooms in the first floor of the smaller volume of the building.

The walls in the upper floor of the larger volume are finished in plaster, while the building's frame is exposed. In the lower floor of the larger volume, plaster walls line the room immediately surrounding the injector, while the remainder of the tunnel has arched metal walls. The flooring in this portion of the building is concrete.

5. Openings

a. Doorways and Doors

There is an interior industrial roll-up door on the lower floor, which connects the injector area to the smaller volume of the building (B110). There are two pairs of double interior doors, one of which sits between Room 105 and 106. The other pair leads from Room 105 to Room 110, which comprises the entire upper floor of the larger volume of the building.

Wall openings within building

b. Windows and Shutters

There are four interior windows in Room 100 that allow for views into Room 106. Similarly, there is a single small window in the southern wall of Room 105A.

6. Decorative Features and Trim



ALISTO ENGINEERING GROUP



As this is an industrial and highly utilitarian building, there are no decorative features or trim present.

7. Hardware

The hardware in this building is most likely of commercial grade, intended for utilitarian purposes.

8. Mechanical Equipment

a. Heating, Air Conditioning, and Ventilation

The heating, air conditioning and ventilation equipment of this building is unknown.

b. Lighting

The light fixtures in Room 100 are recessed fluorescent fixtures, embedded into the dropped ceiling panels. The lighting fixtures in Room 106 are recessed, regularly spaced of an unknown light source or type.

The lighting throughout the remainder of the first and second floors includes a combination of exposed metal reflector hanging fluorescent and ceiling-mounted fluorescent lamps. The area immediately surrounding the injector on the lower level features both single suspended and ceiling mounted incandescent lamps with and without globes.

c. Plumbing

The plumbing system of this building is unknown.

d. Additional

Non-extant mechanical equipment, crucial to the proceedings and function of the ATA facility, has been described in detail in Part B of Section I of this report.

D. SITE

1. Historic Landscape Design

There is no historic landscape design at this site.

2. Outbuildings

The outbuilding present at LLNL's Site 300 include Buildings 865B, C, D, E, F, G, and H as support structures to Building 865A's ATA. Building F was a small concrete extension that connected Building 865A to 865B. Collectively, these buildings that comprised Site 300 were built between 1980 and 1985.

Additionally, there are several smaller auxiliary structures that serviced Building

865A which included a cooling tower, boiler, fuel oil structure, and ion exchange filters immediately to the east, with power supplies, the primary power area and main electrical substation immediately to the building's west. Several spark gap blowers lined the building on either side.

III. SOURCES OF INFORMATION

A. ARCHITECTURAL DRAWINGS

ATA Complex, Lawrence Livermore National Laboratory, Key Plan Area. Lawrence Livermore Laboratory Plant Engineering. LLNL Archives, 2002.

Advanced Test Accelerator Facility Bldg. Plans with Equipment Locations. Lawrence Livermore Laboratory Plant Engineering, drawing PSA 81-865-105D. LLNL Archives, revised April 1981.

Advanced Test Accelerator Facility - Tunnel Extension, Tunnel Top Plan and Finish Grading Plan. Lawrence Livermore Laboratory Plant Engineering, drawing PSA 80-865-110D. LLNL Archives, revised July 1980.

Road Elevations and Lean Concrete Shielding for Acceler. [sic.] Tunnel, Building 865 Advanced Test Accelerator. Lawrence Livermore Laboratory Plant Engineering, drawing PSA 80-865-113B. LLNL Archives, revised Sept. 1980.



B. EARLY VIEWS

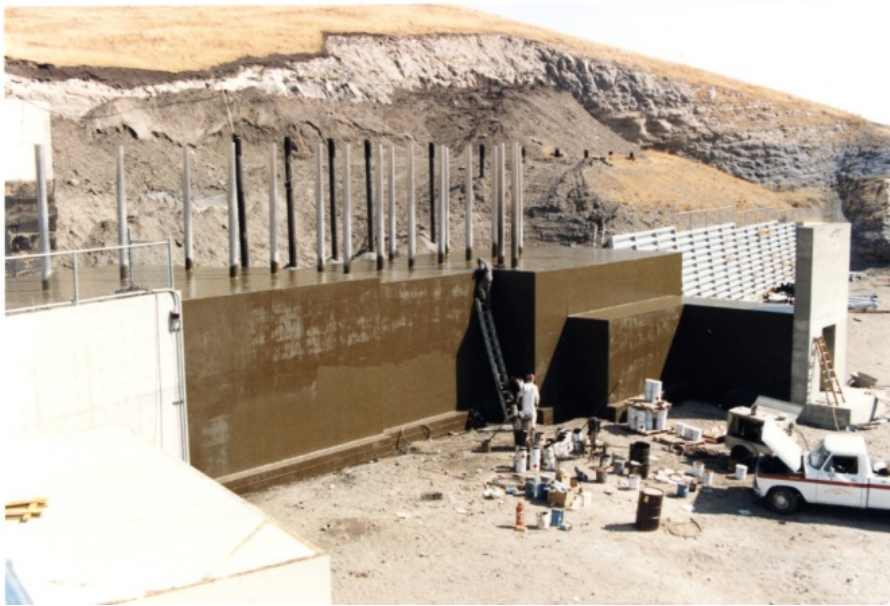


Image 1. Building 865A under construction, c. 1983. LLNL Archives



Image 2. Assembly of steel framework of the larger volume comprising Building 865A, c. 1983 LLNL Archives

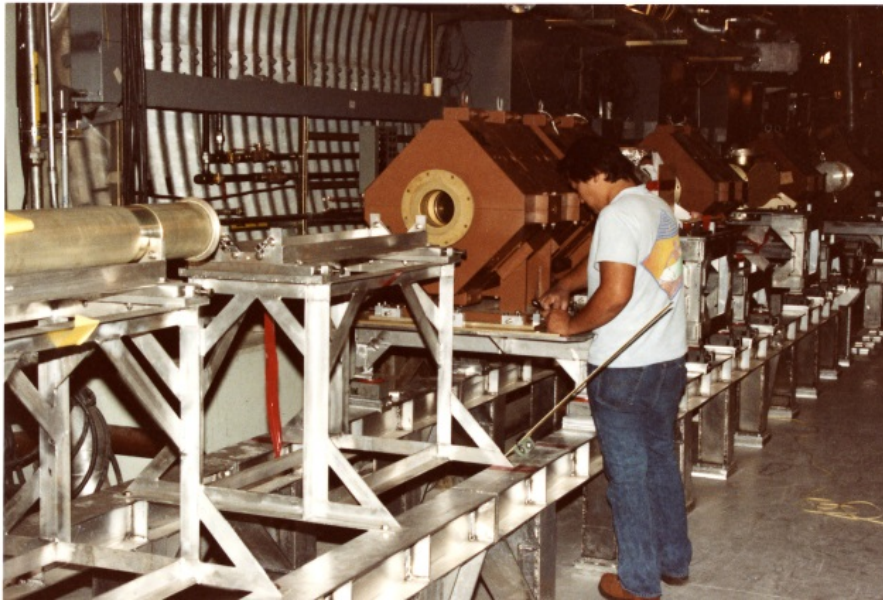


Image 3. ATA tunnel looking south with early accelerator cells, c. 1983 LLNL Archives

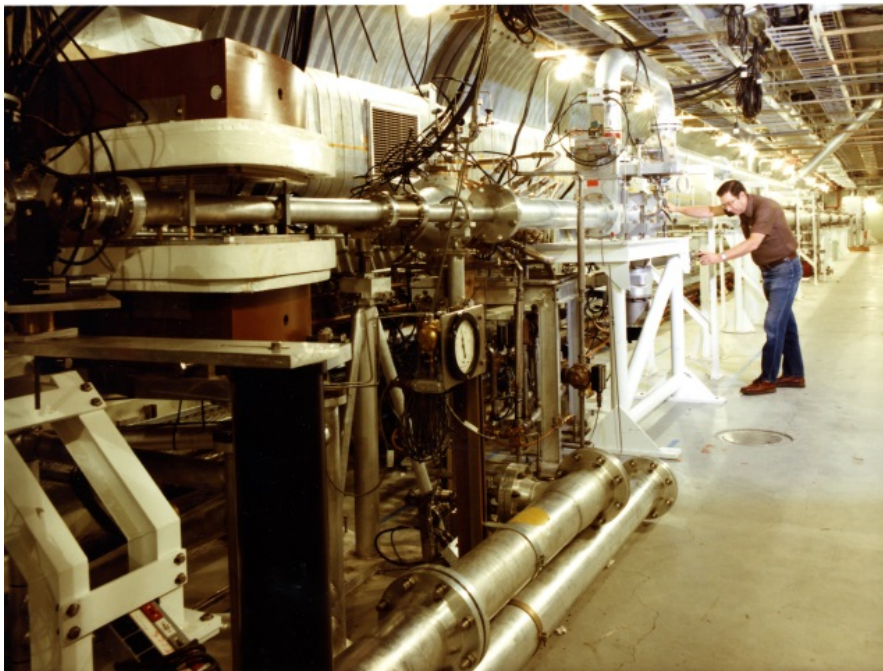


Image 4. ATA tunnel looking south, with electron injector at forefront. c. 1985. LLNL Archives

C. INTERVIEWS

No oral history interviews were conducted.

D. BIBLIOGRAPHY

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Sullivan, Michael A. and Rebecca A. Ullrich. *Lawrence Livermore National Laboratory, Nova Building (Building 391) HABS/HAER Report*. UCRL-TR-232775-DRAFT. Livermore National Laboratory, 2007.

York, Herbert. "Making Weapons, Talking Peace," *Physics Today* (April 1988).

E. LIKELY SOURCES NOT YET INVESTIGATED

There is tremendous related research material from the Energy Research and Development Administration (ERDA) and material in the Office of Fusion Energy/ Office of Energy Research records. The DOE Headquarters and the National Archives would additionally yield information pertinent to this report. Additionally, reports issued by the ICF Laser Program of LLNL may provide extensive technical information on ICF laser technology.

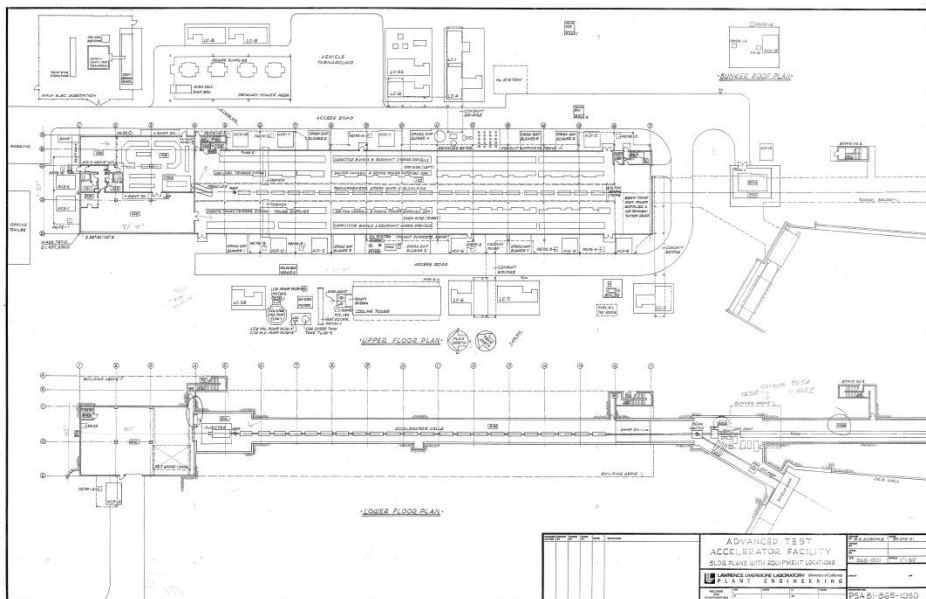
F. SUPPLEMENTAL MATERIAL

See Appendix for additional photographs and drawings from LLNL Archives.

APPENDIX

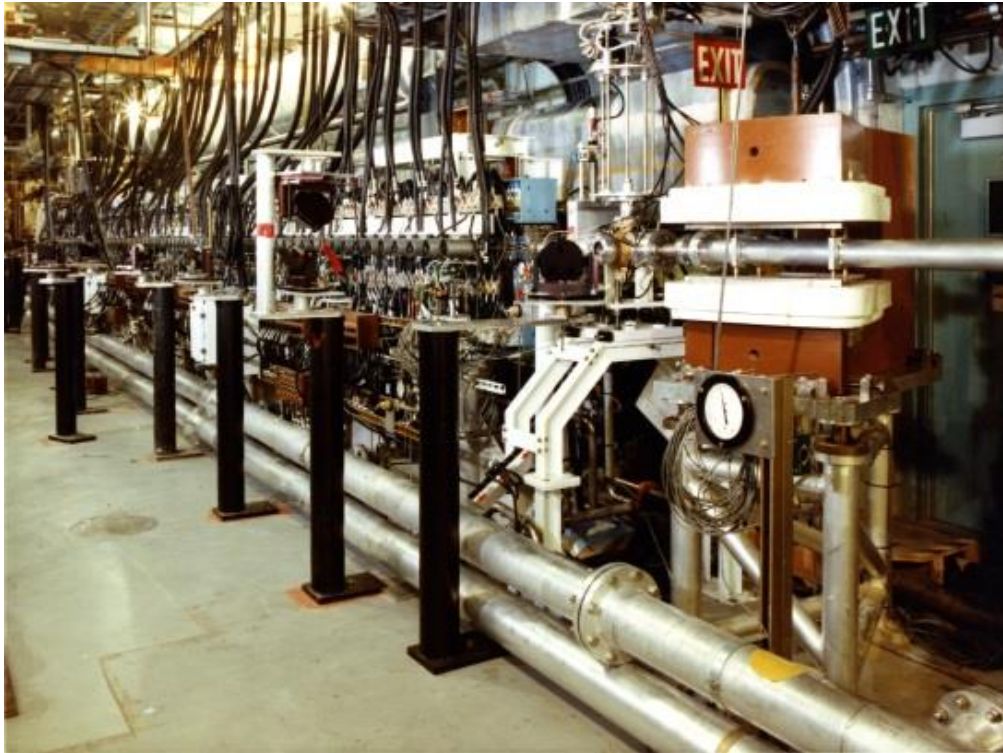


B865A ATA East Elevation, c.2014. J. Sevilla



1980 Plant
Engineering
Documents,
LLNL Archives

APPENDIX



Beam Accelerator, LLNL Archives, 1985



Accelerator cells and oil filled cables. Photo by M. Johnson, 2001

APPENDIX



B865A Mechanical Equipment along East Elevation. c. 2014, J. Sevilla



B865A Mechanical Equipment along East Elevation. c. 2014, J. Sevilla

APPENDIX



Cooling Tower, West of the B865A c. 2014, J. Sevilla

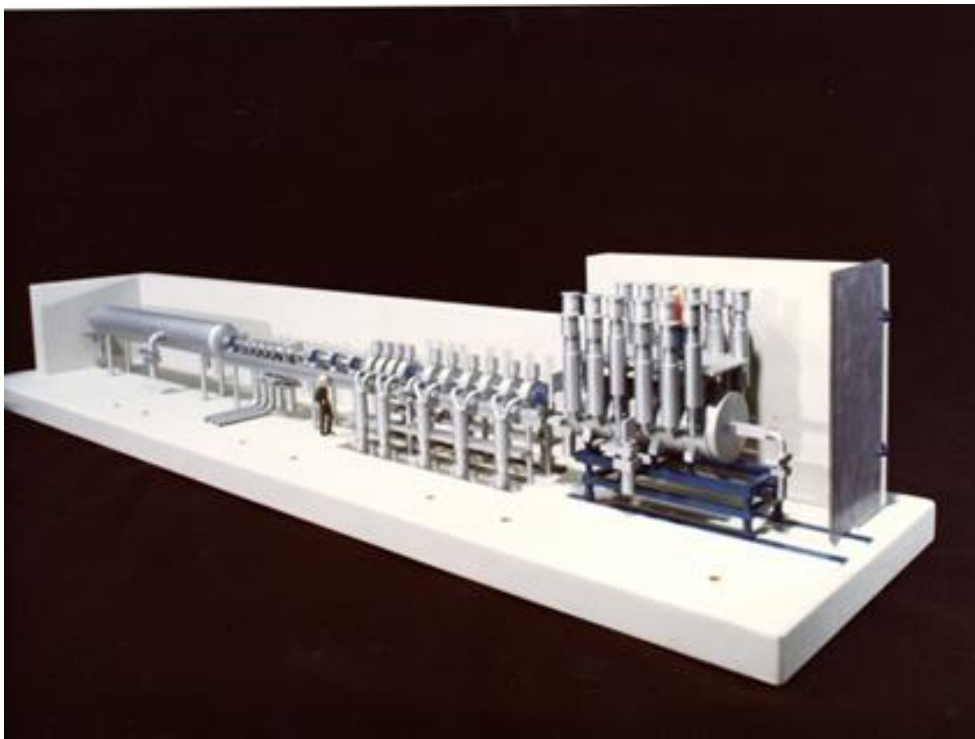


Northwest Entrance to ATA Tunnel, c. 2014, J. Sevilla

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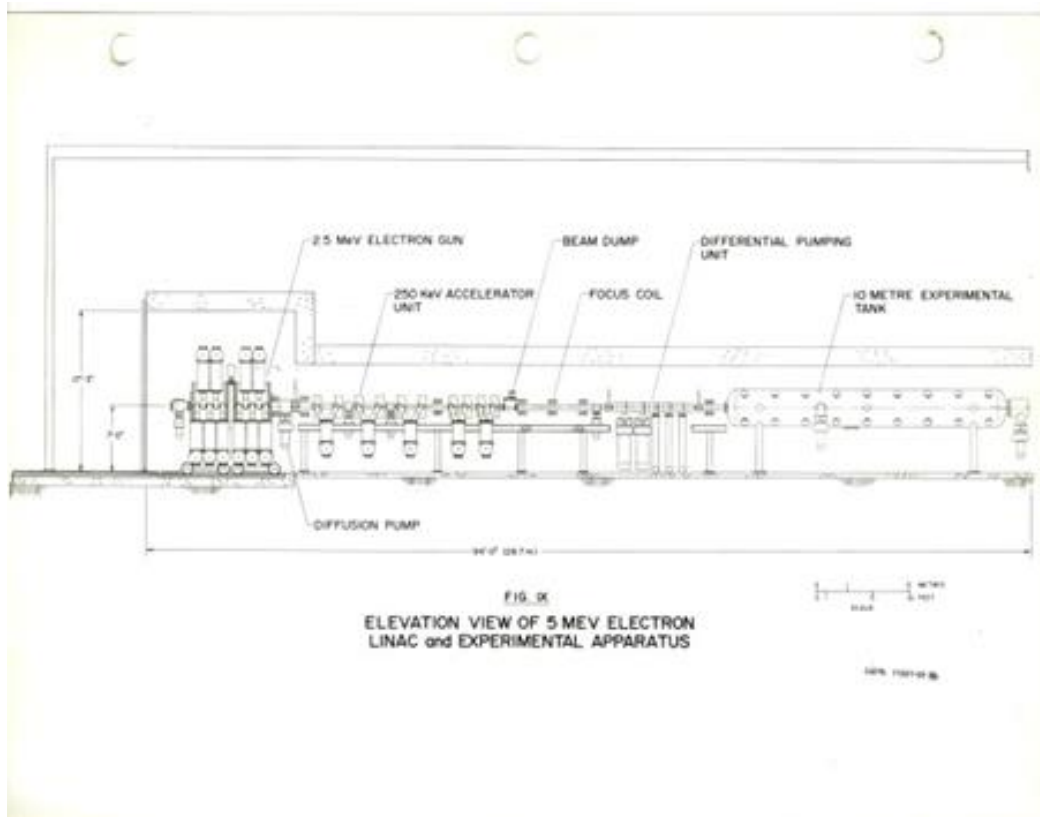


Scanned Image of Control Room, LLNL Archives

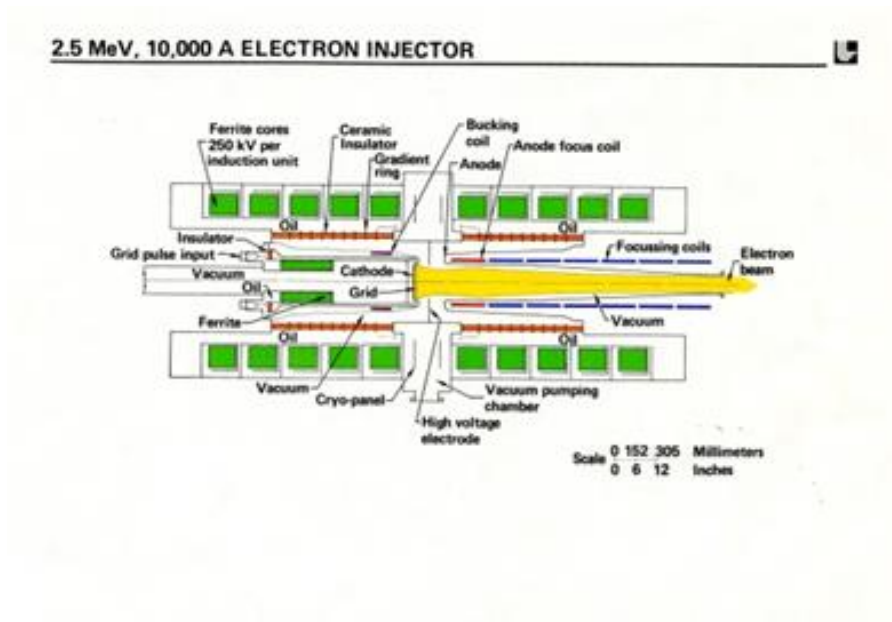


Early Engineering Rendering c. 1980, LLNL Archives

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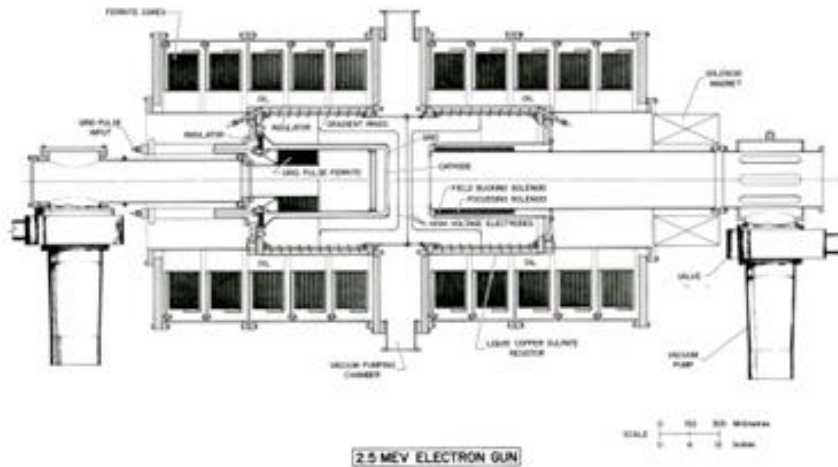


Laser Elevation View Diagram, LLNL Archives

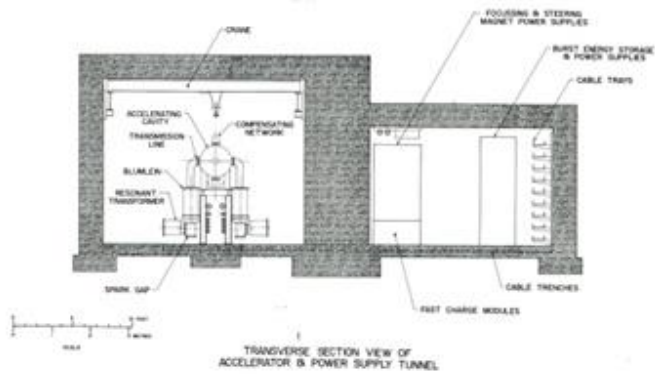


Schematic Process Diagram, LLNL Archives

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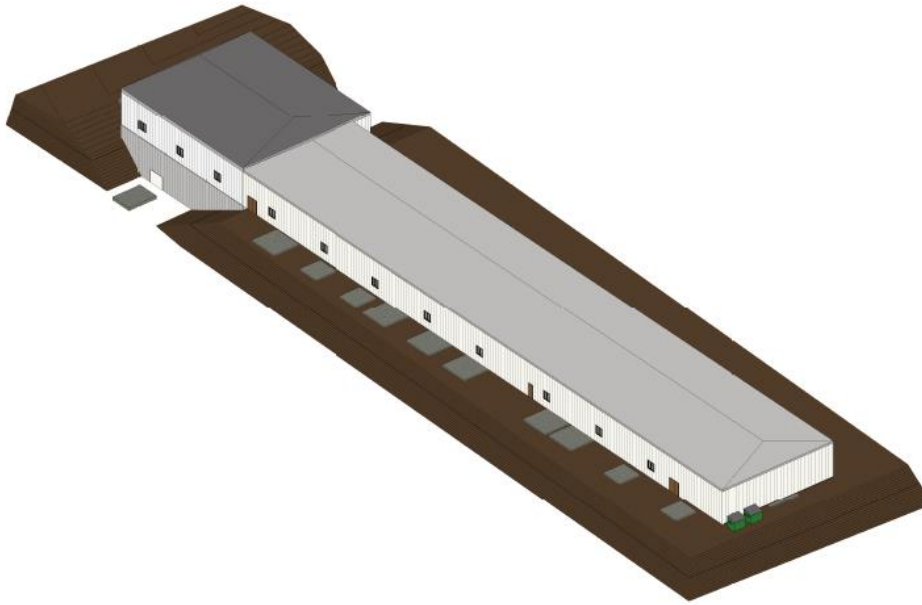


2.5 MEV Electron Gun Cross Section. LLNL Archives

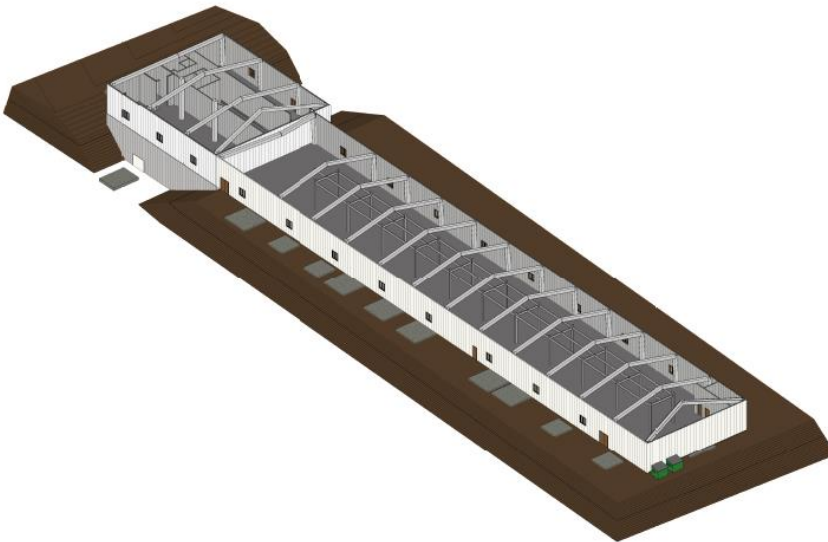


Tunnel Cross Section, Plant Engineering, c. 1980 LLNL Archives

APPENDIX



Building Isometric, Alisto Engr. 2014



Building Isometric Structural View, Alisto Engr.2014

APPENDIX

The following Photos are from unknown sources in LLNL Archives.



Control Panel

